



Safe & Sound Bridge Terminology

Abutment

A retaining wall supporting the ends of a bridge, and, in general, retaining or supporting the approach embankment.

Approach

The part of the bridge that carries traffic from the land to the main parts of the bridge.

Approach Span

The span or spans connecting the abutment with the main span or spans.

Backwater

The increase in the upstream water elevation resulting from an obstruction to flow, such as a bridge and/or embankment placed in the floodplain.

Barrier Rail

A low, reinforced concrete wall along edges of a bridge to prevent vehicles from going over the sides. The railing may or may not adopt some form of safety shape.

Beam

A horizontal structural member supporting vertical loads by spanning from one support to another. A box beam is a hollow box; its cross-section is a rectangle or square.

Bearing

A device at the ends of beams that is placed on top of a pier or abutment. The ends of the beam rest on the bearing, which is an element that provides the interface between the superstructure and the substructure. The bearing transmits load from the superstructure to the substructure as well as allows for thermal movements and rotations due to traffic.

Bearing Pile

A member constructed of steel and/or concrete driven into the ground to carry axial loads. A member of the Substructure.

Bedrock

The solid rock layer beneath sand or silt.

Bent

A type of pier comprised of multiple columns. A rigid frame commonly made of reinforced concrete or steel that supports a vertical load and is placed transverse to the length of a structure. Bents are commonly used to support beams and girders. An end bent is the supporting frame forming part of an abutment.

The vertical members of a bent are columns or piles. The horizontal member resting on top of

the columns is a bent cap. The columns stand on top of some type of foundation, either a footing or a drilled shaft, that is usually hidden below grade.

Bent Cap

A horizontal substructure element that receives the load from the superstructure and transfers the load to columns or piles.

Condition Ratings

According to the National Bridge Inspection Standards (NBIS), condition ratings are used to describe an existing bridge or culvert compared with its condition if it were new. The ratings are based on the materials, physical condition of the deck (riding surface), the superstructure (supports immediately beneath the driving surface), and the substructures (foundation and supporting posts and piers). General condition ratings range from 0 (failed condition) to 9 (excellent).

Through periodic safety inspections, data is collected on the condition of the primary components of a structure. Condition ratings, based on a scale of 0-9, are collected for the following components of a bridge. A condition rating of 4 or less on one of the following item classifies a bridge as structurally deficient.

- The bridge deck, including the wearing surface
- The superstructure, including all primary load-carrying members and connections
- The substructure, considering the abutments and all piers

The lower of the three ratings is the overall rating of the bridge:

9 – Excellent	4 – Poor
8 – Very Good	3 – Serious
7 – Good	2 – Critical
6 – Satisfactory	1 – Imminent Failure
5 – Fair	0 - Failed

Camber

A positive, upward deformation built into a beam due to the application of prestressing forces.

Cast-in-Place

Concrete poured within formwork on site to create a structural element in its final position. On Safe & Sound bridges, the most likely elements to be cast-in-place include bent, bent cap, abutment, wing wall and in some cases deck.

Crashworthy

A system that has been crash tested to establish that its structural and geometric performance is of/at an established level.

Culvert

A drain, pipe or conduit that allows water to pass under a road or railroad embankment.

Deck

The component of a bridge which is driven upon, including shoulders. Some Safe & Sound decks are asphalt while others are constructed as reinforced concrete slabs. Average Daily Traffic determines which surface is used.

Diversion Channel

A bypass created to divert water around a structure so that construction can take place.

Drilled Shaft

The “legs” of the bridge that support the piers and pile cap or footing located underneath the water or ground line; a deep foundation unit embedded in the ground by placing fresh concrete in a drilled hole with steel reinforcement. Drilled shafts derive their capacity from the surrounding soil and/or rock. Sometimes referred to as caissons, bored piles or drilled piers.

Embankment

A raised area of fill used in roadway approaches. In some cases, retaining walls are used to support or “hold in” the fill area where other constraints exist adjacent to the approaches.

End Treatment

The approach end of a parapet or railing that may or may not have a crashworthy configuration depending on approach speeds, geometry and traffic characteristics.

Fill

Earth, stone or other material used to raise the ground level, form an embankment or fill the inside of an abutment, pier or closed spandrel.

Flood Frequency

The concept of the probable frequency of a given flood. More precisely it is the inverse of the probability that a flood will be exceeded at least once in a given year.

Footing

The enlarged lower portion of the substructure or foundation that transfers load from a column directly to the soil, bedrock or piles; usually below grade and not visible.

Freeboard

The clearance between the bottom of the superstructure and the design high-water elevation.

Functionally Obsolete

A functionally obsolete bridge is one that was built to standards that are not used today. These bridges are not automatically rated as structurally deficient, nor are they inherently unsafe. Functionally obsolete bridges are those that do not have adequate lane widths, shoulder widths, or vertical clearances to serve current traffic demand, or those that may be occasionally flooded.

A functionally obsolete bridge is similar to an older house. A house built in 1950 might be perfectly acceptable to live in, but it does not meet all of today’s building codes. Yet, when it comes time to consider upgrading that house or making improvements, the owner must look at ways to bring the structure up to current standards.

Headwall

The device placed at the end of a bridge that comprises a large portion of the abutment. Headwalls are used to retain the road formation soil around and above the abutments and prevent erosion at the abutment.

Parapet

A railing system made of reinforced concrete along the outside edge of a bridge deck used to protect vehicles and pedestrians.

Pier

Also called bent. Typically bents with one column are called piers.

Pile

A long column driven deep into the ground to form part of a foundation or substructure. (See *Bearing Pile*).

Post-tensioning

Application of tensile forces to the steel tendons after the segments are in place. These forces allow the span to carry the desired loads.

Pre-Cast Girder

Girder is fabricated off-site of Portland cement using reinforcing steel and post-tensioning cables. These girders are shipped to the construction site by truck and hoisted into place by cranes.

Prestressed Concrete

A type of pre-cast concrete girder in which compressive stresses are introduced by the application of prestressing forces in a fabrication facility. The prestressing tendons are stretched, the concrete cast and set around them and then released from the form. These forces allow the member to carry larger loads than conventional reinforcement.

Reinforced Concrete

Concrete with steel bars or mesh embedded in it for increased strength and durability.

Revetment

A facing of masonry or stones to protect an embankment from erosion.

Rip Rap

Gabions, stones, blocks of concrete or other protective covering material of like nature deposited upon river and stream beds and banks, to prevent erosion and scour by water flow.

Scour

Removal of material from the streambed or embankment as a result of erosive action of stream flow.

Simple Span

A span in which the effective length is the same as the length of the spanning structure. The spanning superstructure extends from one vertical support, abutment or pier to another without crossing over an intermediate support or creating a cantilever.

Skew

When the superstructure is not perpendicular to the substructure, a skew angle is created. The skew angle is the angle between the alignment of the superstructure and the alignment of the substructure.

Span

The horizontal space between two supports of a structure. Also refers to the structure itself. The clear span is the space between the inside surfaces of piers or other vertical supports. The effective span is the distance between the centers of two supports.

Structurally Deficient

Bridges are considered structurally deficient if significant load-carrying elements are found to be in poor condition due to deterioration or the adequacy of the waterway opening provided by the bridge is determined to be extremely insufficient to the point of causing intolerable traffic interruptions.

Every bridge constructed goes through a natural deterioration or aging process, although each bridge is unique in the way it ages.

The fact that a bridge is classified under the federal definition as "structurally deficient" does not imply that it is unsafe. A structurally deficient bridge, when left open to traffic, typically requires significant maintenance and repair to remain in service and eventual rehabilitation or replacement to address deficiencies. To remain in service, structurally deficient bridges are often posted with weight limits to restrict the gross weight of vehicles using the bridges to less than the maximum weight typically allowed by statute.

Substructure

The substructure consists of all parts that support the superstructure. The main components are:

- Abutments or end-bents
- Piers or interior bents
- Foundation
- Footings
- Piling

Superstructure

The component of a bridge which supports the deck or riding surface of the bridge. The superstructure consists of the components that actually span the obstacle the bridge is intended to cross. It includes:

- Bridge deck,
- Structural members
- Parapets, handrails, sidewalk, lighting and drainage features

Tendon

Steel strands used for post tensioning.

Wearing Surface

The topmost layer of material applied upon a roadway to receive the traffic loads and to resist the resulting disintegrating action; also known as wearing course.

Wing Walls

The retaining wall extension of an abutment intended to retain the side slope material of an approach roadway embankment.